Spatial positioning and spectral characterization of InAs/InP quantum dots in the p-i-n structure emitting in the telecom C-band

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Generating single photons and entangled photon pairs in the telecom C-band is crucial for long-distance quantum communication through fiber-based infrastructure. Self-assembled InAs/InP quantum dots (QDs) can be used as an essential element of the photon state generator. However, achieving high process yield and high performance of the photon source (high emission purity and photon indistinguishability) requires precise positioning of the QD in an engineered environment[1]. This is difficult due to the self-assembly process of InAs/InP QDs, which leads to random nucleation. Another major challenge for a single QD-based photon source is the control over its charge environment, as the charge fluctuations environment can deteriorate the source performance (e.g. coherence)[1,3].

In this contribution, we present an optical 2D imaging setup used for InAs/InP QD localization in a planar structure (Fig.1a).[1] The setup allows for the pre-selection of QDs with specific emission properties based on user specifications (emission wavelength, biexciton-exciton binding energy, or intensity of charged complexes emission). We will present a prototype device that contains a single QD in the *p-i-n* junction placed on an Al mirror to enhance QD emission visibility[2] (Fig. 1b). We have employed high spatially resolved photoluminescence time- and polarization-resolved photoluminescence to examine the emission properties of each device (Fig.1c). We have demonstrated autocorrelation and cross-correlation measurements for selected emission lines originating from different exciton complexes from a single QD.

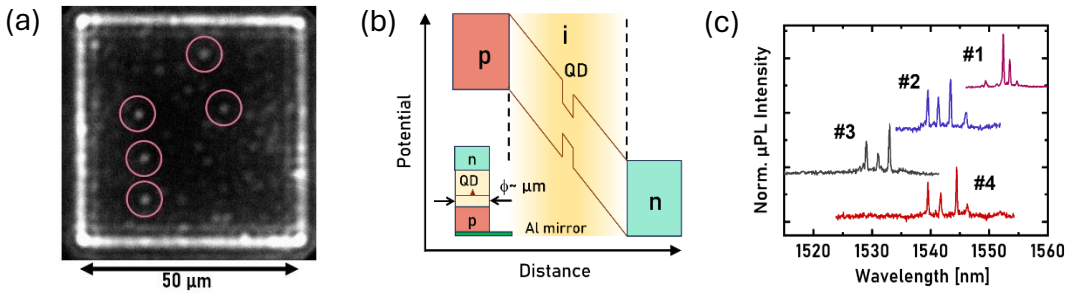

Figure 1 (a) Exemplary 2D image of a 50×50 µm^2 field with QDs emitting in the C-band. (b) Scheme of the *p-i-n* device with a single QD. (c) Emission from selected *p-i-n* devices.

References

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